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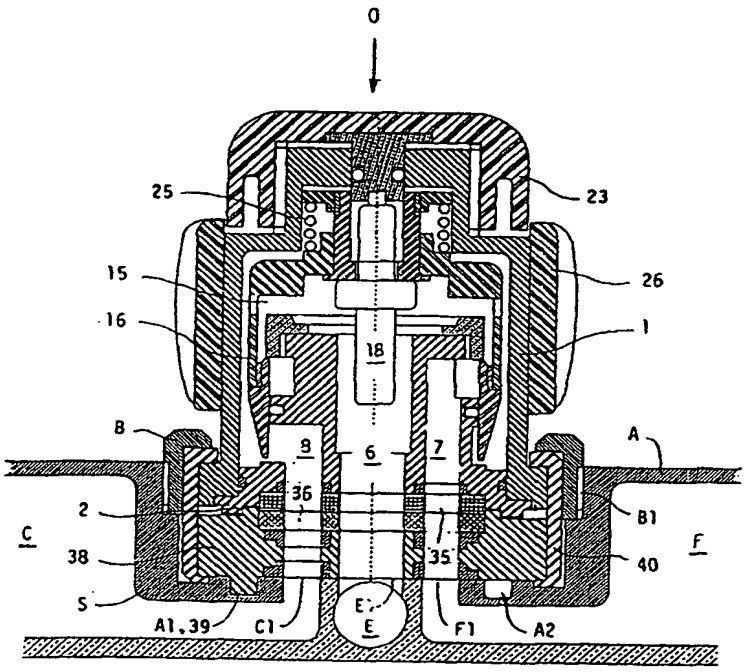
(54) Title: THERMOSTATIC MIXING DEVICE

(57) Abstract

A thermostatic mixer (0) to be applied to a collector (A), that comprises, within a main body (1), two inlet ducts (7, 8) for cold water and for hot water, a mixing chamber (15), passageways between the inlet ducts (7, 8) and the mixing chamber (15), an outlet duct (6) that starts from the mixing chamber (15), a thermometric dilatation element (18), so placed as to be washed by the mixed water, and a distribution slide valve (16), activated by the thermometric element (18) and acting upon the mentioned passageways in order to keep the temperature of the mixed water constant, the outlet and inlet ducts (6, 7, 8) being embodied within an internal body (2) arranged inside the slide valve (16) that is activated by the thermometric element (18), wherein all parts of the mixer (0) that are intended to be applied to the collector (A) are combined so as to constitute a cartridge, the outlet duct (6) is central, the two inlet ducts (7, 8) are arranged at the two sides of the outlet duct (6), these three ducts (6, 7, 8) are aligned along a diameter, and between the mixer (0) and the collector (A) there are provided reference means (39, A1, A2) suitable for permitting the installation of the cartridge mixer (0) in the collector (A) in two different positions, corresponding to the two possible different connections to the collector (A) of the feed pipes for the cold water and the hot water.



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DESCRIPTION

THERMOSTATIC MIXING DEVICE

The subject of this invention is a thermostatic mixing device. More precisely, the invention relates to improvements made in a thermostatic mixing device, especially in the thermostatic mixing device that is the subject of European Patent No. 0.707.720, held by same owner. This known thermostatic mixing device comprises two inlet ducts for the hot water and for the cold water, a mixing chamber, passageways between the inlet ducts and the mixing chamber, an outlet duct that starts from the mixing chamber, a thermometric dilatation element arranged at least partly in the outlet duct to be washed by the mixed water, and a distribution slide valve activated by the thermometric element and acting on one or both of the passageways to keep the temperature of the mixed water constant, the inlet and outlet ducts being embodied within an internal body arranged inside the slide valve that is activated by the thermometric element. In the known form, this structure is directly assembled in the appropriate seat of a feed and delivery collector, which has at least one reference means in order to univocally ensure the correct placement of the parts. Because of the univocal placement of the parts, in this known thermostatic mixing device there is no specific requirement about the positions of the openings communicating the thermostatic mixing device with the feed and delivery collector.

The structure of this known thermostatic device turns out to be very advantageous; however, it does entail some inconveniences. In particular, the feed collector must be linked to the pipes when being already provided with the mixing device, because the latter is assembled in the seat of the collector and could not be moved away from it without giving rise to the disassembly of its parts. The fact that the mixing device is already applied to the collector does not facilitate the installation operations and makes it possible to damage the mixing device during the installation operation. Moreover, if the feed and delivery collector is connected to the feed pipes by inverting the cold water and hot water inlets, then the mixing device cannot work. That case may happen not only due to a mistake, but it also tends to occur systematically when two mixing devices must be installed on the two opposite

sides of a wall in which run the feed pipes (so-called "back-to-back" plants). In such cases, one must modify the connections or employ a differently arranged mixing device. One could not even think of modifying the arrangements of the mixing device at the site, because it is assembled in the seat foreseen in the collector, and its disassembly and reassembly could not be performed by a simple plumbing installer.

Therefore, the main object of this invention is to improve a mixing device of the mentioned kind in order that it can be easily adapted to various arrangements of the hot water and cold water inlets.

Another object of the invention is to facilitate an easy conversion of the mixing device so as to adapt it to various feed water pressures or to various requirements for the limitation of the water delivery rate.

Yet another object of the invention is to make it easier to manufacture, store and install the mixing devices.

Finally, another object of the invention is to introduce said improvements without complicating the structure of the mixing device and without increasing its production costs.

The first object of the invention can be achieved, in a mixing device such as the one cited in the introduction, by virtue of the fact that all of the parts of the mixing device, which are intended to be applied to the collector, are combined so as to constitute a cartridge, that the outlet duct is central, that the two inlet ducts are arranged at the two sides of the outlet duct, that these three ducts are aligned along a diameter, and that between the mixing device and the collector there are provided reference means suitable for permitting the installation of the cartridge mixing device in the collector in two different positions, corresponding to the two possible different connections to the collector of the feed pipes for the cold water and the hot water.

The fact that the mixing device forms a cartridge which is assembled independently of the collector for which it is intended does facilitate its manufacture and storage and, above all, makes it possible to install the collector in the plant before installing the mixing device in the collector. This facilitates the installation operations and prevents any possible damage to the mixing device during the collector installation operation. When the cartridge mixing device is then installed in the collector, it is possible to choose two different positions for its installation, corresponding to the two different possi-

bilities of connecting the collector to the inlet pipes of the waters, and therefore, the same mixing device can always be employed and function correctly, regardless of which way the collector is connected to the feed pipes for the waters. In practice, it is not even necessary to make a priori a choice between the two possible positions for the installation of a mixing device, and it will suffice to install it in any one of the two possible positions, because, if that position then turns out not to be the correct one, the operation of moving the mixing device away from the collector and its renewed installation in the other position are matters of utmost simplicity.

The reference means that are intended to establish the possible positions for the installation of the mixing device in the collector preferably comprise one or more projections presented by an element of the mixing device, and corresponding cavities presented by the seat of the collector in diametrically opposite positions.

Preferably, the various parts of the mixing device that are intended to be introduced into the appropriate seat of the collector are connected to form a cartridge by virtue of a ring that surrounds the parts and prevents their disassembly. This ring can advantageously be made of a plastic material offering a low friction coefficient, so as also to perform the function of reducing the resistance opposed to the operation by the mixing device. This ring can advantageously be inserted with elastic release, in order to facilitate to the maximum possible extent the operations involved in assembly during the manufacture of the mixing device.

The inlet duct intended for the passage of cold water can advantageously end, on the surface that is intended to come into contact with the collector, with a seat which is suitable for receiving a nozzle capable of limiting its passage cross-section. When one inserts or extracts a nozzle in this place and thus limits or leaves clear the passage cross-section, the mixing device can easily be converted so as to adapt it to the high or low pressure of the feed water.

Also the inlet duct intended for the passage of the hot water can end, on the surface intended to come into contact with the collector, with a seat suitable for receiving a nozzle capable of limiting its cross-section. By inserting or extracting this nozzle, one can either introduce or eliminate a limitation to the maximum volume of water that can be delivered by the mixing

device.

These and other features, objects and advantages of the subject of this invention will appear more clearly by the following description of an embodiment, constituting a non-restrictive example, with reference to the attached drawings, wherein:

Figure 1 illustrates a thermostatic mixing device according to the invention, installed on the pertinent feed and delivery collector;

Figure 2 illustrates the feed and delivery collector represented in Figure 1, isolated;

Figure 3 illustrates the thermostatic mixing device shown in Figure 1, isolated;

Figure 4 illustrates the same thermostatic mixing device of Figure 3, but rotated by 180°;

Figure 5 illustrates a variant of the thermostatic mixing device according to Figure 3, and a limiting nozzle that can be inserted therein; and

Figure 6 illustrates the thermostatic mixing device shown in Figure 5, rotated by 180° and with the limitation nozzle inserted.

The general internal structure of the mixing device and the general structure of the collector shown in Figures 1, 2 and 3 in substance correspond to the structures described in European Patent No. 0.707.720, and they will therefore be described here only in a summary fashion, by referring for more extensive explanations to the cited document, which is to be intended as incorporated herein for reference.

The feed and delivery collector comprises a body A in which are present a chamber C, intended to be connected to a hot water inlet pipe, a chamber F, intended to be connected to a cold water inlet pipe, and a chamber E, intended to be connected to a mixed water delivery pipe. Body A of the collector includes a portion S that defines a seat S1, intended to receive a thermostatic mixing device, and it is provided with a fixing collar B, applied in any fashion so as to be dismountable, in the example screwed at B1, in order to retain the thermostatic mixing device in its seat. Chambers C, F and E open at the interior surface of seat S1 with respective openings C1, F1 and E1. In contrast to what was not necessarily provided according to European Patent No. 0.707.720, opening C1 is central, and the two openings F1 and E1, situated at the two sides of opening C1, are arranged aligned with it along a di-

ameter of seat S1. Furthermore, body A of the collector has reference means to establish the position for the installation of the mixing device; instead of defining only a single position, as according to the European Patent No. 0.707.720, these reference means make it possible to install the mixing device in two different positions which are relatively rotated by 180°. For the purpose of obtaining clarity in the drawing, these reference means are shown as two depressions or cavities A1 and A2, situated along the same diameter according to which are aligned openings C1, E1 and F1, although it is to be understood that there can also be more than just one of these cavities for each position, and they can be situated in other planes, provided that to each cavity A1, pertaining to a position for the installation of the mixing device, there corresponds a cavity A2 turned by 180° with respect to cavity A1, so that corresponding projections 39, presented (as it will be explained later on) by a part of the thermostatic mixing device 0, by cooperating with one or the other cavities presented by the collector, will permit the installation of the thermostatic device in two positions shifted by 180° with respect to each other and with respect to the collector A.

The thermostatic mixing device, generally designed as 0, comprises a main body 1 that is intended to be installed in seat S1 of the collector and to be retained there by collar B. In those cases in which the thermostatic mixing device is intended to function also as a faucet for controlling the volume of delivered water, the main body 1 must be mounted rotatably in seat S1 of the collector, and it is then usually provided with a thermally insulating covering 26 that also acts as an operating handle.

Main body 1 has associated with it an internal body 2 in which are provided a central delivery duct 6, intended to communicate with delivery chamber E of the collector, and two inlet ducts, 7 for the cold water and 8 for the hot water, which are intended to communicate (directly or through flow control means), respectively, to the feed chambers F and C of the collector, and which are arranged on the two sides of delivery duct 6; the three ducts 6, 7 and 8 are all aligned along a diameter of the internal body 2.

The internal structures of the thermostatic device are not of any concern to this invention and they will therefore be described here only generically, also because the invention could be applied to thermostatic mixing devices that have different internal structures. The shown structure comprises a

thermometric dilatation element 18, arranged so as to be washed by the mixed water that flows through delivery duct 6, and this thermometric element activates a slide valve 16 that controls passageways existing between inlet ducts 7 and 8 and a mixing chamber 15, so as to keep the temperature of the mixed water constant. An operating knob 23 makes it possible to set the desired value for this temperature, by shifting the point of support of the thermometric element 18. A safety spring protects the parts against excessive stresses.

These structures could, however, be modified, provided that they permit the central placement of the delivery duct 6 and the placement of the inlet ducts 7 and 8 each in a position diametrically adjacent to it, said conditions being necessary in order that the invention may be applied to the thermostatic mixing device.

In those cases in which the device is intended to work also as a faucet, between internal body 2 and the feed and delivery collector, also flow control means should be provided, for example in the form of a pair of plates made of hard material, namely, a movable plate 35, solid with internal body 2, and a fixed plate 36, solid with a support body 38. It is furthermore to be understood that any type of flow control means could be employed instead of these plates made of hard material. The delivered flow of water is regulated by the user by rotating the main body 1 of the device, grasping it in correspondence of the insulating covering 26 that operates as a handle.

In order to ensure that the position adopted by supporting body 38 with respect to the collector will permit the establishment of the above described communications, supporting body 38 has a projection 39 that is intended to be inserted in cavity A1 of the collector when the latter is linked to the feed pipes in the previously described fashion. However, since cavity A2 also exists in the collector, projection 39 can also be inserted in this latter cavity A2, thus inverting the position of the thermostatic mixing device, so as to restore a correct communication of ducts 7 and 8 with the cold water feed pipe and, respectively, the hot water feed pipe, in those cases in which the functions of chambers F and C in the collector have been inverted.

It should be noted that, in those cases in which the thermostatic mixing device is not intended to work as a faucet, for example, if it has a central character or if the flow is controlled by a separate faucet acting on a pipe that

conducts the mixed water, then the described flow control means inside the thermostatic mixing device and the supporting body 38 can also be omitted. In this case, reference projection 39 can be presented directly by internal body 2.

It is obvious that, in order to invert the position of the thermostatic mixing device, it must be moved away from the collector, rotated by 180° and inserted once again in seat S1. To ensure that this operation can be performed without the parts constituting the thermostatic mixing device becoming disassembled, there is provided a retaining ring 40 which, when inserted, makes integral the main body 1 of the device, the internal body 2, and, if it exists, the supporting body 38. In this way, the entire thermostatic mixing device takes on the character of a cartridge that can be installed in and extracted from the collector A without causing any disassembly of the parts. The same feature makes it possible, during the manufacture phase, to mount the entire device independently of the collector, and during the storage phase to keep the two parts 0 and A separate.

Retaining ring 40 can be made of plastic material and it can be suitably fixed with an elastic release. One can advantageously employ a plastic material having a low friction coefficient, so that ring 40 will also act to limit the resistance opposed by the thermostatic mixing device to the rotation which is to be performed in order to regulate the volume of delivered water, when the thermostatic mixer device also operates as a faucet.

In Figure 1, the thermostatic mixing device 0 is illustrated installed on the collector A, in the position which corresponds to the correct connection of the collector to the feed pipes. The two parts that are illustrated as being mutually connected in Figure 1 are shown isolated, in the same position, in Figures 2 and 3. Figure 4 illustrates the thermostatic mixing device after it has been rotated by 180° with respect to Figure 3, and one can thus see that the device 0 can be installed on the collector A also in this position, by inserting projection 39 in cavity A2 of the collector, whereas in the preceding case it was inserted in cavity A1. In this case, one can establish the correct routing of the cold water to the inlet duct 7 and of the hot water to inlet duct 8 in those cases in which chamber F of the collector is linked to the hot water inlet and chamber C of the collector is linked to the cold water inlet. It is thus evident that any error in installation can be easily corrected by extracting the

thermostatic mixing device from the collector and reinserting the same after having rotated it by 180°.

Figure 5 illustrates the device according to Figure 3, equipped with a feature that makes it possible to adapt it to correct operation under various feed pressures. In this case, the outward opening of the passage that extends towards inlet duct 7 for the cold water has a seat 41 that can receive the introduction of a nozzle 42, which is then illustrated as being inserted in seat 41 in Figure 6.

When the device is not provided with nozzle 42, it has a free passage for the cold water and it is thus suitable for operating under a low-pressure feed, for example, less than 1 bar, such as it takes place in plants that are fed by drop from a tank. On the other hand, if nozzle 42 is inserted, the cold water passage is choked and the device is thus suitable for working under high-pressure feed, for example, in excess of 1 bar, as it takes place in plants supplied from a high-pressure water pipeline.

A similar arrangement (not shown) can be adopted for the outward opening of the passage which extends towards inlet duct 8 for hot water. The insertion of a nozzle also in the passage of the hot water makes it possible to limit the maximum water volume delivered by the thermostatic mixing device, in those cases in which such a limitation is desired or required by regulations.

The mentioned nozzles can also be advantageously employed to optimize the operation of the thermostatic mixing device in conditions where there is a great pressure difference between the hot and cold water feeds. For example, it may happen that the cold water is fed from a high-pressure water pipeline, for example under a pressure of about 3 bar, while the hot water is fed by gravity at a low pressure, for example between 0,1 and 0,3 bar. In such a case, the operation of the device can be seriously disturbed; but this can be avoided by inserting the proper nozzles in the manner indicated above, during the actual installation of the thermostatic mixing device.

It is to be understood that the invention is not restricted to the embodiments described and illustrated by way of example. Several modifications, in addition to those already described, are within reach of those skilled in the art; for example, collar B of collector A could be fixed in a manner different from threading B1; retaining ring 40 could be metallic and it could be fixed in a manner different from an elastic release; and various packings, that

have not been illustrated to simplify the illustration, are to be provided to establish the necessary sealing.

These and other modifications and any substitution by technically equivalent means can be introduced without departing from the spirit of the invention and the scope of this patent, as defined by the annexed Claims.

CLAIMS

THERMOSTATIC MIXING DEVICE

1 . Thermostatic mixing device (0) comprising, within a main body (1) intended to be applied into a seat (S1) of a collector (A), two inlet ducts (7,8) for cold water and for hot water, a mixing chamber (15), passageways between the inlet ducts (7,8) and the mixing chamber (15), an outlet duct (6) that starts from the mixing chamber (15), a thermometric dilatation element (18) arranged at least partly in the outlet duct (6), so placed as to be washed by the mixed water, and a distribution slide valve (16), activated by the thermometric element (18) and acting upon at least one of said passageways in order to keep the temperature of the mixed water constant, the outlet and inlet ducts (6,7,8) being embodied within an internal body (2) arranged inside the slide valve (16) that is activated by the thermometric element (18), characterized in:

that all of the parts of the mixing device (0) that are intended to be applied to the collector (A) are combined so as to constitute a cartridge,

that the outlet duct (6) is central,

that the two inlet ducts (7,8) are arranged at the two sides of the outlet duct (6),

that these three ducts (6,7,8) are aligned along a diameter, and

that between the mixer (0) and the collector (A) there are provided reference means (39,A1,A2) suitable for permitting the installation of the cartridge mixing device (0) in the collector (A) in two different positions, corresponding to the two different possible connections to the collector (A) of the feed pipes for the cold water and the hot water.

2 . Thermostatic mixing device according to Claim 1, characterized in that the reference means (39,A1,A2), intended to establish the positions permitted for the mixing device (0) on the collector (A), comprise one or more projections (39) presented by an element of the mixing device (0), and by corresponding cavities (A1,A2) presented by the seat (S1) of the collector (A) in diametrically opposite positions.

3 . Thermostatic mixing device according to Claim 1, characterized in that the various parts of the mixing device (0), intended to be introduced into the seat (S1) of the collector (A), are combined to form a cartridge by virtue of a ring (49) that surrounds them and prevents their separation.

4 . Thermostatic mixing device according to Claim 3, characterized in that said ring (40) is made of a plastic material having a low friction coefficient so as also to perform the function of reducing the resistance opposed by the mixing device to the operation thereof.

5 . Thermostatic mixing device according to Claim 3, characterized in that said ring (40) is inserted with elastic release so as to facilitate to the maximum possible extent the operations required for assembly during the manufacture of the mixing device.

6 . Thermostatic mixing device according to Claim 1, characterized in that the inlet duct (7) intended for the passage of the cold water ends, on the surface that is intended to come into contact with the collector (A), with a seat (41) suitable for receiving a nozzle (42) capable of limiting the cross-section of the duct (7), so that, by inserting or removing the nozzle (42), the mixing device can be converted to adapt it for operation with high-pressure or with low-pressure feed water.

7 . Thermostatic mixing device according to Claim 6, characterized in that also the inlet duct (8) intended for the passage of the hot water ends, on the surface that is intended to come into contact with the collector (A), with a seat suitable for receiving a nozzle capable of limiting the cross-section of the duct (8), so that, by inserting or removing the nozzle, a limitation to the maximum water volume that can be delivered by the mixing device can be obtained or eliminated.

8 . Thermostatic mixing device, characterized by the features, arrangements and operation, as they appear from the above description and attached drawings, or replaced by technically equivalent means, taken as a whole, in their various combinations or separately.

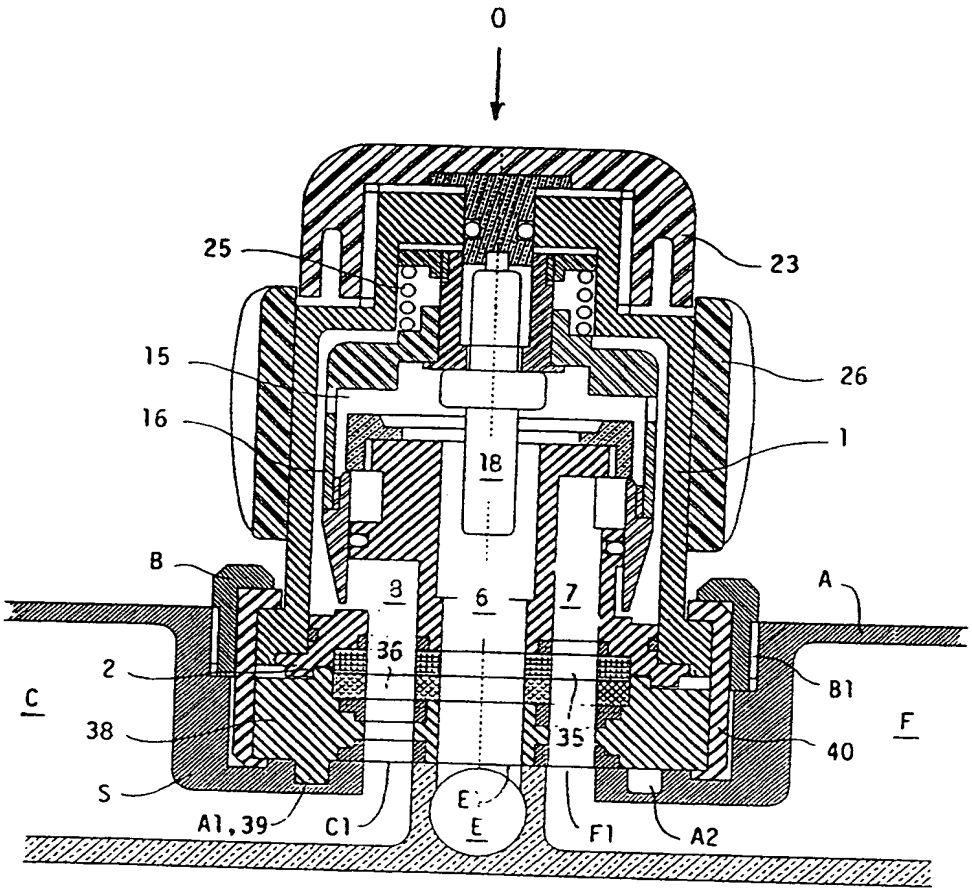

FIG. 1

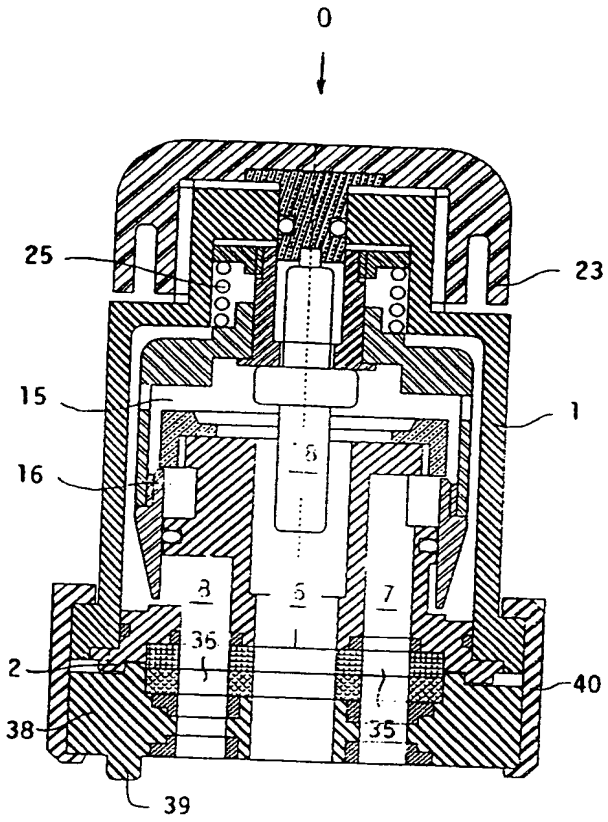

FIG. 3

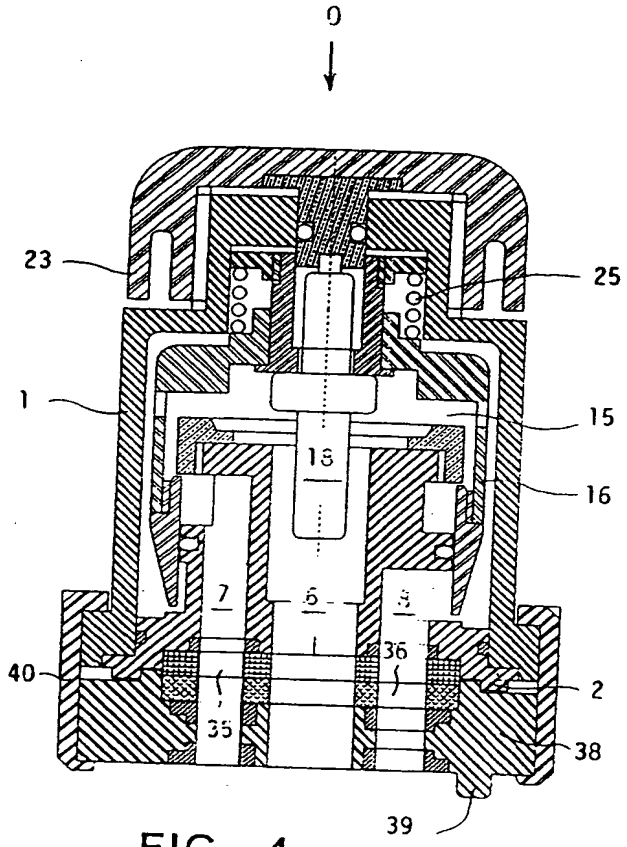

FIG. 4

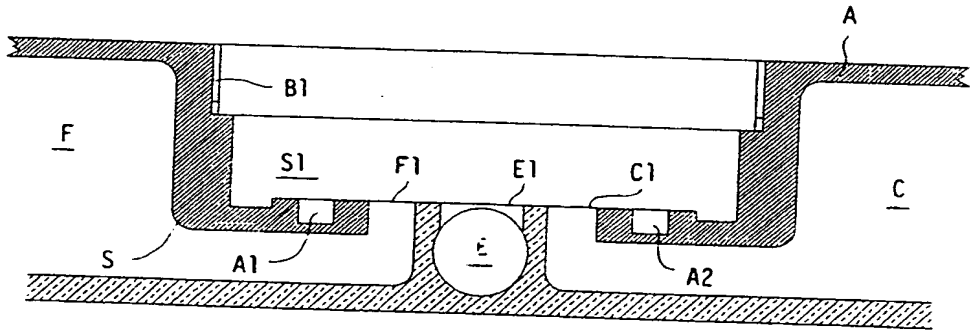

FIG. 2

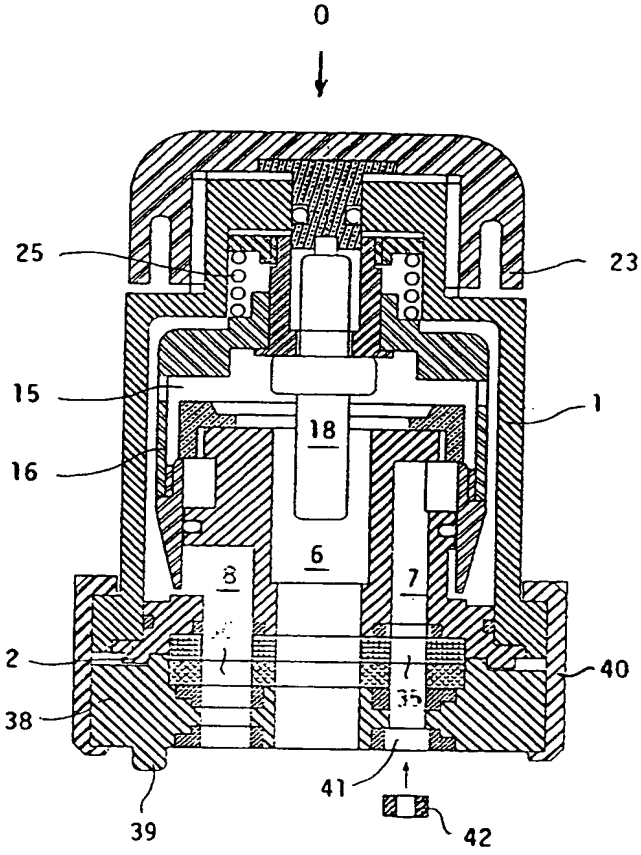
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FIG. 5

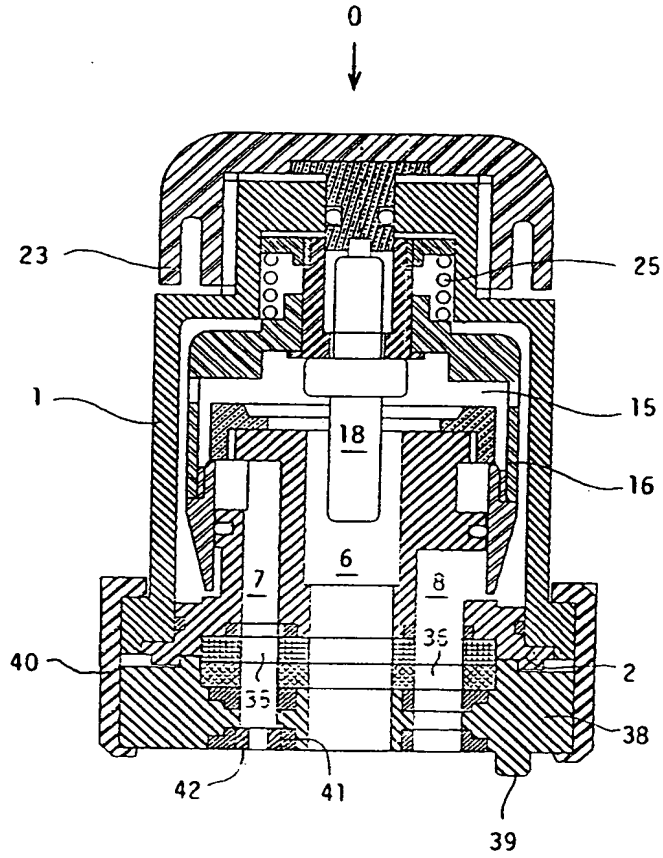
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FIG. 6

INTERNATIONAL SEARCH REPORT

In ational Application No
PCT/EP 00/01650

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G05D23/13

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G05D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 901 916 A (AVELOEV ROLF I) 20 February 1990 (1990-02-20) column 3, line 28 -column 4, line 22; figures 1,7A,7B	1,3-7
A	DE 38 00 305 C (DANFOSS A/S) 30 March 1989 (1989-03-30) column 5, line 23 -column 7, line 19; figures 1,4	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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